

FORM PTO-1390 (REV. 1-95)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				Mo-5366/LeA 32,344
INTERNATIONAL APPLICATION NO.	PCT/EP98/02553	INTERNATIONAL FILING DATE	April 30, 1998	U.S. APPLICATION NO. (If known) 37 CFR 1.5 TO 09/429572
TITLE OF INVENTION		HEAT-SEALABLE FILTER MATERIAL WITH BIODEGRADABLE POLYMERS		
APPLICANT(S) FOR DO/EO/US Ralf Timmermann; Ernst Grigat; Wolfgang Schulz-Schlitte; Sabine Schroft; Richard Grangladden; Günter Heinrich				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li><input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li><input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))           <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li><input type="checkbox"/> has been transmitted by the International Bureau.</li> <li><input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)</li> </ol> </li> <li><input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li><input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))           <ol style="list-style-type: none"> <li><input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li><input type="checkbox"/> have been transmitted by the International Bureau.</li> <li><input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li><input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li><input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li><input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li><input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol>				
Items 11. to 16. below concern other document(s) or information included:				
<ol style="list-style-type: none"> <li>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</li> <li>14. <input type="checkbox"/> A substitute specification.</li> <li>15. <input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li>16. <input checked="" type="checkbox"/> Other items or information: Abstract; copy of PCT/1B/306; 3 pages of drawings; PTO Form 1449 and references listed therein</li> </ol>				

US

Annex US.II, page 2

## PCT Applicant's Guide - Volume II - National Chapter - US

420 Rec'd PCT/PTO 10 NOV 1999

U.S. APPLICATION NO. (Reference, see 37 CFR 1.5)		INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER	
109/13848-72 TBA		PCT/EP98/02553	MO-5366/LeA 32,344	
17. <input checked="" type="checkbox"/> The following fees are submitted:				
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO.....		\$ 840.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) .....		\$ 670.00		
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).		\$ 760.00		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37CFR 1.445(a)(2)) paid to USPTO.....		\$ 970.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4). ....		\$ 96.00		
<b>ENTER APPROPRIATE BASIC FEE AMOUNT</b>		\$ 840.00		
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$		
Claims	Number Filed	Number Extra	Rate	
Total Claims	14-20 -		X\$18.00 \$	
Independent Claims	1 - 3 -		X\$78.00 \$	
Multiple dependent claims(s) (if applicable)		+260.00 \$		
<b>TOTAL OF ABOVE CALCULATIONS</b>		\$ 840.00		
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).		\$		
		<b>SUBTOTAL</b> = \$ 840.00		
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		+ \$		
		<b>TOTAL NATIONAL FEE</b> = \$ 840.00		
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +		\$		
		<b>TOTAL FEES ENCLOSED</b> = \$ 840.00		
		<b>Amount to be:</b>	\$	
		<b>refunded</b>	\$	
		<b>charged</b>	\$	
<p>a. <input type="checkbox"/> A check in the amount of \$ _____ to cover the above fees is enclosed.</p> <p>b. <input checked="" type="checkbox"/> Please charge my Deposit Account No. 13-3848 in the amount of \$ 840.00 to cover the above fees. A duplicate copy of this sheet is enclosed.</p> <p>c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-3848. A duplicate copy of this sheet is enclosed.</p>				
<p><b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b></p>				
<p>SEND ALL CORRESPONDENCE TO:</p> <p>Bayer Corporation Patent Department 100 Bayer Road Pittsburgh, PA 15205-9741</p>				
 <p>SIGNATURE Joseph C. Gil</p>				
<p>NAME 26,602</p>				
<p>REGISTRATION NUMBER</p>				

09/423572

420 Rec'd PCT/PTO 10 NOV 1999

PATENT APPLICATION  
Mo-5366  
LeA 32,344

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION OF )  
RALF TIMMERMANN ET AL ) PCT/EP98/02553  
SERIAL NUMBER: TO BE ASSIGNED )  
FILED: HEREWITH )  
TITLE: HEAT-SEALABLE FILTER )  
MATERIAL WITH BIODEGRAD- )  
ABLE POLYMERS )

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents

Washington, D.C. 20231

Sir:

Prior to its examination, please amend the enclosed English language translation of the application as follows:

IN THE SPECIFICATION:

At the top of page 1, change the title to read: "Heat-sealable filter material with biodegradable polymers".

IN THE ABSTRACT

Please change the Abstract to read as follows:

"Heat-sealable filter material with biodegradable polymers

Abstract of the Disclosure

A filter material comprising at least two-ply structure, wherein at least one ply contains natural fibers and one ply biodegradable, thermoplastic fibers is disclosed. The thermoplastic fibers are selected from the group comprising aliphatic or

"Express Mail" mailing label number \_\_\_\_\_ PCT/EP98/02553  
Date of Deposit \_\_\_\_\_ November 10, 1999

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231

Donna J. Veatch

(Name of person mailing paper or fee)

Signature of person mailing paper or fee

partially aromatic polyesteramides, aliphatic or partially aromatic polyesters, aliphatic or partially aromatic polyesterurethanes, aliphatic or aliphatic-aromatic polyestercarbonates. The filter material is suitable for the preparation of tea bags, coffee bags, as well as tea filters and coffee filters."

IN THE CLAIMS:

Please amend the claims as follows:

Cancel Claims 2, 6 and 7.

1. (Amended) A multi-plied filter material [consisting of an] comprising at least [two-ply structure, wherein at least] one ply [contains] containing natural [fibres] fibers and one ply containing biodegradable, thermoplastic fibers made of a member [fibres, wherein the thermoplastic fibres are] selected from the group [comprising] consisting of aliphatic polyesteramides, [or] partially aromatic polyesteramides, aliphatic polyesters, [or] partially aromatic polyesters, aliphatic Polyesterurethanes, [or] partially aromatic polyesterurethanes, aliphatic Polyestercarbonates and [or] aliphatic-aromatic polyestercarbonates.
3. (Amended) A filter material according to [claims 1 and 2.] Claim 1 wherein [the first ply is] said natural fibers comprise a mixture of coniferous wood, deciduous wood, manilla, hemp, jute[, sisal and similar natural fibres] and sisal.
4. (Amended) A filter material according to [claims 1 to 3.] Claim 1 wherein [the first ply] one ply containing natural fibers has a basis weight of between 8 and 40 g/m<sup>2</sup> and an air permeability of 300 to 4000 l/m<sup>2</sup>.sec (DIN 53 887).
5. (Amended) A filter material according to [claims 1 to 4.] Claim 1 wherein [the second ply,] one ply containing [consisting of the] biodegradable thermoplastic [fibres,] fibers has a basis weight of 1 to 15 g/m<sup>2</sup>.

Add the following:

- 8. The filter material of Claim 1 wherein thermoplastic fibers are made of aliphatic polyesteramides.

9. The filter material of Claim 1 wherein thermoplastic fibers are made of partially aromatic polyesteramides.

10. The filter material of Claim 1 wherein thermoplastic fibers are made of aliphatic polyesters.

11. The filter material of Claim 1 wherein thermoplastic fibers are made of partially aromatic polyesters.

12. The filter material of Claim 1 wherein thermoplastic fibers are made of aliphatic polyesterurethanes.

13. The filter material of Claim 1 wherein thermoplastic fibers are made of partially aromatic polyesterurethanes

14. The filter material of Claim 1 wherein thermoplastic fibers are made of aliphatic polyestercarbonates

15. The filter material of Claim 1 wherein thermoplastic fibers are made of aliphatic-aromatic polyestercarbonates.

16. A tea bag comprising the filter material of Claim 1.

17. A coffee bag comprising the filter material of Claim 1. --

**REMARKS**

The present amendment seeks to avoid multiple dependencies of the several claims and to place the application, including the drawings, in better conformance with U.S. practice. A page containing a revised abstract is also enclosed. An early examination is requested.

Respectfully submitted,

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- 19 -

Abstract Of The Disclosure

**Heat-sealable filter material with biodegradable polymers**

A filter material comprising at least two-ply structure, wherein at least one ply contains natural fibers and one ply biodegradable, thermoplastic fibers is disclosed. The thermoplastic fibers are selected from the group comprising aliphatic or partially aromatic polyesteramides, aliphatic or partially aromatic polyesters, aliphatic or partially aromatic polyetherurethanes, aliphatic or aliphatic-aromatic polyestercarbonates. The filter material is suitable for the preparation of tea bags, coffee bags, as well as tea filters and coffee filters.

Heat-sealable filter material containing biodegradable polymers

This invention relates to a filter material consisting of at least one ply of natural fibres and at least a second ply of heat-sealable synthetic material, which is biodegradable.

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EP-A 0 380 127 A2 describes, for example, a heat-sealable tea bag paper and the process for the production thereof, wherein the heat-sealing phase contains polyethylene and/or polypropylene and/or a copolymer of vinyl chloride and vinyl acetate and the basis weight of this material is between 10 and 15 g/m<sup>2</sup>.

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EP-A 656 224 (application number 94 107 709.1) describes a filter material, in particular for the production of tea bags and coffee bags or filters, having a basis weight of between 8 and 40 g/m<sup>2</sup>, in which the heat-sealing ply consists of plastic fibres, preferably polypropylene or polyethylene, which are laid in the heated state onto the first ply consisting of natural fibres.

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German application DE-A 2 147 321 (US priority 23.09.70, US 74 722) describes a thermoplastic, heat-sealable composition consisting of a polyolefin powder (polyethylene or polypropylene) which is embedded in a matrix material of vinyl chloride/vinyl acetate copolymer. This material is also used to provide a heat-sealable finish on a fibrous material produced using papermaking techniques.

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All these stated filter materials require a content of at least 20 to 30 wt.% of thermoplastic material, relative to the total basis weight of the filter material, in order to produce a filter bag by heat sealing.

It is known that used filter materials, for example tea bags, coffee bags or also other filters are disposed of on a compost heap or in the biowaste bin. After a certain period of time, which is dependent upon further parameters such as temperature, atmospheric humidity, microorganisms etc., the natural fibre component of the filter bag has decomposed and biodegraded, while the thermoplastic network of polymer fibres remains and reduces the quality of the compost.

On the other hand, it is not possible to separate the natural fibre component from the thermoplastic, non-biodegradable polymer, *i.e.* the used filter bag would have to be classed as non-reutilisable waste (grey bin).

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The object of the invention is accordingly to provide a completely biodegradable, heat-sealable filter material which is compostable, so constituting the most favourable solution both environmentally and economically. It is also intended to describe processes for the production of such filter materials.

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The present invention provides a filter material consisting of an at least two-ply structure, wherein at least one ply contains natural fibres and one ply biodegradable, thermoplastic fibres, wherein the thermoplastic fibres are selected from the group comprising aliphatic or partially aromatic polyesteramides, aliphatic or partially aromatic polyesters, aliphatic or partially aromatic polyesterurethanes, aliphatic or aliphatic-aromatic polyestercarbonates.

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Thermoplastic fibres may both be applied onto the ply of natural fibres in an operation on the papermaking machine and laid onto this paper ply of natural fibres in the heated state using a melt-blowing process and be fused both with themselves and with the paper ply.

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The first ply of the filter material generally has a basis weight of between 8 and 40 g/m<sup>2</sup>, preferably of 10 to 20 g/m<sup>2</sup> and air permeability of 300 to 4000 l/m<sup>2</sup>.sec (DIN 53 887), preferably of 500 to 3000 l/m<sup>2</sup>.sec.

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The second layer of the filter material preferably has a basis weight of 1 to 15 g/m<sup>2</sup>, preferably of 1.5 to 10 g/m<sup>2</sup>.

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The first ply of the filter material made from natural fibres is preferably provided with wet strength.

The filter material is used, for example, for the production of tea bags, coffee bags or tea or coffee filters.

The filter material may be produced in the following manner:

5        In a first stage, an aqueous suspension of the natural fibres is applied onto a paper-making machine wire and, in a second stage, the heat-sealable, biodegradable polymer fibres are laid onto the natural fibre layer in such a manner that they partially penetrate the natural fibre layer, wherein interpenetration of the two layers may be adjusted by  
10      the degree of dewatering on the wire. Known natural fibres, such as hemp, manilla, jute, sisal and others, as well as long-fibre woodpulp, are used for the first layer and produced on a papermaking machine in a manner known *per se*.

15      According to the invention, a biodegradable, thermoplastic polymer in fibre form is used for the second layer, which polymer is selected from the group comprising aliphatic or partially aromatic polyesteramides, aliphatic or partially aromatic polyesters, aliphatic or partially aromatic polyesterurethanes, aliphatic or aliphatic-aromatic polyestercarbonates.

20      Biodegradable and compostable polymers which may be considered are aliphatic or partially aromatic polyesters, thermoplastic aliphatic or partially aromatic polyesterurethanes, aliphatic or aliphatic-aromatic polyestercarbonates, aliphatic or partially aromatic polyesteramides.

25      The following polymers are suitable:

aliphatic or partially aromatic polyesters prepared from

A)      aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol or particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having 5 or 6 C atoms in the cycloaliphatic ring, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric  
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or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkyldiols, such as for example neopentyl glycol, and additionally optionally small quantities of more highly functional alcohols, such as for example 1,2,3-propanetriol or trimethylolpropane and from aliphatic bifunctional acids, preferably C<sub>2</sub>-C<sub>12</sub> alkylidicarboxylic acids, such as for example and preferably succinic acid, adipic acid and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid or

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B) from acid- and alcohol-functionalised units, preferably having 2 to 12 C atoms in the alkyl chain, for example hydroxybutyric acid, hydroxyvaleric acid, lactic acid or the derivatives thereof, for example  $\epsilon$ -caprolactone or dilactide,

or a mixture and/or a copolymer prepared from A and B,

wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to  
20 all the acids.

Aliphatic or partially aromatic polyesterurethanes prepared from

C) aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol, particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having a C<sub>5</sub> or C<sub>6</sub> cycloaliphatic ring, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkyldiols, such as for example neopentyl glycol, and

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- additionally optionally small quantities of more highly functional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkylpolyols, such as for example 1,2,3-propanetriol or trimethylolpropane and from aliphatic bifunctional acids, preferably C<sub>2</sub>-C<sub>12</sub> alkylidicarboxylic acids, such as for example and preferably, succinic acid, adipic acid, and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid, or
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- 10 D) from acid- and alcohol-functionalised units, for example having 2 to 12 C atoms, for example hydroxybutyric acid, hydroxyvaleric acid, lactic acid or the derivatives thereof, for example  $\epsilon$ -caprolactone or dilactide,
- or a mixture and/or a copolymer prepared from C and D,
- 15
- wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to all the acids;
- 20 E) from the reaction product of C and/or D with aliphatic and/or cycloaliphatic bifunctional and additionally optionally more highly functional isocyanates, preferably having 1 to 12 C atoms or 5 to 8 C atoms in the case of cycloaliphatic isocyanates, for example tetramethylene diisocyanate, hexamethylene diisocyanate, isophorone diisocyanate, optionally additionally with linear and/or branched and/or cycloaliphatic bifunctional and/or more highly functional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkylidiols or alkylpolyols or 5 to 8 C atoms in the case of cycloaliphatic alcohols, for example ethanediol, hexanediol, butanediol, cyclohexanedimethanol, and/or optionally additionally with linear and/or branched and/or cycloaliphatic bifunctional and/or more highly functional amines and/or aminoalcohols preferably having 2 to 12 C atoms in the alkyl chain, for example ethylenediamine or aminoethanol, and/or optionally further modified amines or alcohols, such as for example ethylenediaminoethanesulphonic acid, as the free acid or as a salt,
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wherein the ester fraction C) and/or D) amounts to at least 75 wt.%, relative to the sum of C), D) and E).

- 5      Aliphatic or aliphatic-aromatic polyestercarbonates prepared from
- F)     aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol or particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having 5 to 8 C atoms in the cycloaliphatic ring, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably with C<sub>2</sub>-C<sub>12</sub> alkylidicarboxylic acids, such as for example neopentyl glycol, and additionally optionally small quantities of more highly functional alcohols, such as for example 1,2,3-propanetriol or trimethylolpropane and from aliphatic bifunctional acids, such as for example and preferably, succinic acid, adipic acid, and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid, or
- G)     from acid- and alcohol-functionalised units, for example having 2 to 12 C atoms in the alkyl chain, for example hydroxybutyric acid, hydroxyvaleric acid, lactic acid or the derivatives thereof, for example  $\epsilon$ -caprolactone or dilactide,
- 25     or a mixture and/or a copolymer prepared from F and G,
- 30     wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to all the acids,

- H) a carbonate fraction which is produced from aromatic bifunctional phenols, preferably bisphenol A, and carbonate donors, for example phosgene, or  
5 a carbonate fraction which is produced from aliphatic carbonic acid esters or the derivatives thereof, such as for example chlorocarbonic acid esters or aliphatic carboxylic acids or the derivatives thereof, such as for example salts and carbonate donors, for example phosgene, wherein  
the ester fraction F) and/or G) amounts to at least 70 wt.%, relative to the sum of F),  
10 G) and H).

Aliphatic or partially aromatic polyesteramides prepared from

- I) aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol, particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having 5 to 8 C atoms, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkylglycols, such as for example neopentyl glycol, and additionally optionally small quantities of more highly functional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkylpolyols, such as for example 1,2,3-propanetriol, trimethylolpropane and from aliphatic bifunctional acids, preferably having 2 to 12 C atoms in the alkyl chain, such as for example and preferably succinic acid, adipic acid and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid or  
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- K) from acid- and alcohol-functionalised units, preferably having 2 to 12 C atoms in the carbon chain, for example hydroxybutyric acid, hydroxyvaleric acid, lactic acid or the derivatives thereof, for example  $\epsilon$ -caprolactone or dilactide,
- 5 or a mixture and/or a copolymer prepared from I) and K),
- wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to all the acids,
- 10 L) an amide fraction prepared from aliphatic and/or cycloaliphatic bifunctional and/or optionally small quantities of branched bifunctional amines, with linear aliphatic C<sub>2</sub> to C<sub>10</sub> diamines being preferred, and additionally optionally small quantities of more highly functional amines, the amines preferably being hexamethylenediamine, isophoronediamine and particularly preferably hexamethylenediamine, and from linear and/or cycloaliphatic bifunctional acids, preferably having 2 to 12 C atoms in the alkyl chain or a C<sub>5</sub> or C<sub>6</sub> ring in the case of cycloaliphatic acids, preferably adipic acid, and/or optionally small quantities of branched bifunctional and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalene-dicarboxylic acid and additionally optionally small quantities of more highly functional acids, preferably having 2 to 10 C atoms, or
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- M) from an amide fraction prepared from acid- and amine-functionalised units, preferably having 4 to 20 C atoms in the cycloaliphatic chain, preferably  $\omega$ -laurolactam,  $\epsilon$ -caprolactam, particularly preferably  $\epsilon$ -caprolactam,
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or a mixture prepared from L) and M) as the amide fraction, wherein

the ester fraction I) and/or K) amounts to at least 30 wt.%, relative to the sum of I),  
30 K), L) and M), with the fraction by weight of the ester structures preferably amounting to 30 to 70 wt.%, and the fraction of the amide structures to 70 to 30 wt.%.

During the production process, the synthetic biodegradable heat-sealing fibres of the second ply partially penetrate the first ply and, during the drying process on the papermaking machine, in a molten state enclose the natural fibres. The pores necessary for filtration are kept clear during this operation.

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The invention is illustrated below by means of the drawings.

Figure 1 shows a general, broadly diagrammatic representation of the various stages in the formation of the filter material according to the invention from natural fibres and synthetic fibres.

Figure 1 shows a diagrammatic representation of the formation of the filter material according to the invention. Figure 1a) shows the formation of a first fibre layer from natural fibres 1 and the formation of a second fibre layer from synthetic, biodegradable, heat-sealable fibres 2. The second layer is thus formed using the fibres 2 by deposition on top of the first layer, which is formed by the natural fibres 1. For the purposes of differentiation in the drawing, the natural fibres 1 are shown with horizontal hatching, while the synthetic fibres 2 are shown with approximately vertical hatching.

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Figure 1b) shows how, by means of the stated dewatering of the two layers, in particular the second layer containing the fibres 2, partial interpenetration of the two layers is achieved, the synthetic fibres 2 passing between the natural fibres 1.

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In a further production stage, the partially interpenetrating layers 1 and 2 are dried, during which operation they are heated in such a manner that the synthetic fibres 2 melt and, after resolidification, lie around the fibres 1 in such a manner that these latter fibres are at least partially enclosed. The filter material has thus become heat-sealable (figure 1c).

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Figure 2 shows the essential structure of a papermaking machine, as may be used for the production of a filter material according to the invention. First of all, a suspension

"A" is prepared from the ground natural fibres and water, while a suspension "B" is also prepared from the partially ground synthetic fibres and water.

5 These two suspensions A and B are transferred from their individual tanks (3 and 4) into the papermaking machine via the so-called head box. This essentially comprises a circulating wire (5), which is conveyed through a number of dewatering chambers (6, 7 and 8).

10 By means of suitable pipework and pumping apparatus, which are not shown in any further detail, suspension A, on the wire 5, is passed through the first two dewatering chambers 6, wherein the water is drawn off by the chambers 6 and the dewatering line. This results in the formation of a first fibre layer of natural fibres 1 on the moving wire 5. As the wire 5 moves onwards through the dewatering chambers 7, the second suspension B is introduced, wherein the second layer of synthetic fibres is deposited 15 on the first layer in the dewatering chambers 7. Dewatering proceeds by means of the dewatering line. As the wire 5 bearing the two superposed fibre layers moves onwards through the dewatering chambers 8, further dewatering is performed, as a result of which the two layers partially interpenetrate. The degree of interpenetration may be increased or reduced by appropriate adjustment of the dewatering.

20 The material 9, which has now been formed from natural fibres and synthetic fibres, is removed from the wire and dried. Drying may proceed in various manners, for example by contact drying or by through-flow drying.

25 The units 10 give only a general diagrammatic indication of suitable drying units.

Figure 2 shows three drying cylinders 10, by means of which the formed paper web is dried by the contact process. It is, however, also practicable to pass the formed paper web over only one cylinder and to dry it with hot air without the web lying on this 30 cylinder.

Heating of the two-layer fibre material causes the synthetic fibres 2 in the mixed layer 9 to melt. After resolidification on leaving the drying apparatus, the synthetic fibres at least partially enclose the natural fibres and the heat-sealable filter material is wound onto a reel 11.

5

A second production process for a biodegradable, heat-sealable filter material is performed as follows:

If the biodegradable polymer is in pellet form, it may be shaped into fibres using the melt-blown process and deposited while still hot and tacky onto a substrate, for example a paper made from natural fibres.

This is a prior art process, but the essentials of the process shown in figure 3 are nonetheless briefly described below:

15

The dried pellets 12 are conveyed into an extruder 13, in which they are melted and heated to the temperature required for fibre formation. This heated polymer melt then passes into the MB spinneret 14. This spinneret has a large number of small orifices through which the polymer melt is pressed and drawn into fibres. A strong stream of air is directed onto these fibres 15 immediately below the spinneret, the fibres are stretched further, torn into varying lengths and deposited onto a substrate, for example a paper 16, which lies upon a suction roll 17. Since these fibres are still in a hot, tacky state, they adhere to the natural fibres of the paper. Once cool, the material is wound on the winder 18. Typical diameters of these melt-blown fibres are between 2 and 7 µm. Figure 3 is a diagrammatic representation of the melt-blowing process.

**Patent Claims**

1. A filter material consisting of an at least two-ply structure, wherein at least one  
5 ply contains natural fibres and one ply biodegradable, thermoplastic fibres,  
wherein the thermoplastic fibres are selected from the group comprising aliphatic or partially aromatic polyesteramides, aliphatic or partially aromatic polyesters, aliphatic or partially aromatic polyesterurethanes, aliphatic or aliphatic-aromatic polyestercarbonates.
- 10 2. A filter material according to claim 1, wherein the thermoplastic fibres are selected from among the following polymers:  
aliphatic or partially aromatic polyesters prepared from
- 15 A) aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol or particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having 5 or 6 C atoms in the cycloaliphatic ring, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkylglycols, such as for example neopentyl glycol, and additionally optionally small quantities of more highly functional alcohols, such as for example 1,2,3-propanetriol or trimethylolpropane and from aliphatic bifunctional acids, preferably C<sub>2</sub>-C<sub>12</sub> alkyl-dicarboxylic acids, such as for example and preferably succinic acid, adipic acid and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid or
- 20
- 25
- 30

- 5           B) from acid- and alcohol-functionalised units, preferably having 2 to 12  
C atoms in the alkyl chain, for example hydroxybutyric acid, hydroxy-  
valeric acid, lactic acid or the derivatives thereof, for example  
ε-caprolactone or dilactide,
- 10           or a mixture and/or a copolymer prepared from A and B,  
wherein the aromatic acids constitute a fraction of no more than 50 wt.%,  
relative to all the acids;
- 15           aliphatic or partially aromatic polyesterurethanes prepared from
- 20           C) aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols,  
such as for example ethanediol, butanediol, hexanediol, particularly  
preferably butanediol and/or optionally cycloaliphatic bifunctional al-  
cohols, preferably having a C<sub>5</sub> or C<sub>6</sub> cycloaliphatic ring, such as for ex-  
ample cyclohexanedimethanol, and/or, partially or entirely instead of  
the diols, monomeric or oligomeric polyols based on ethylene glycol,  
propylene glycol, tetrahydrofuran or copolymers thereof having mo-  
lecular weights of up to 4000, preferably of up to 1000, and/or op-  
tionally small quantities of branched bifunctional alcohols, preferably  
C<sub>3</sub>-C<sub>12</sub> alkyldiols, such as for example neopentyl glycol, and addi-  
tionally optionally small quantities of more highly functional alcohols,  
preferably C<sub>3</sub>-C<sub>12</sub> alkylpolyols, such as for example 1,2,3-propanetriol  
or trimethylolpropane and from aliphatic bifunctional acids, preferably  
C<sub>2</sub>-C<sub>12</sub> alkyldicarboxylic acids, such as for example and preferably,  
succinic acid, adipic acid, and/or optionally aromatic bifunctional ac-  
ids, such as for example terephthalic acid, isophthalic acid, naphthale-  
nedicarboxylic acid and additionally optionally small quantities of  
more highly functional acids, such as for example trimellitic acid, or

- D) from acid- and alcohol-functionalised units, for example having 2 to 12 C atoms, for example hydroxybutyric acid, hydroxyvaleric acid, lactic acid or the derivatives thereof, for example  $\epsilon$ -caprolactone or dilactide,
- 5 or a mixture and/or a copolymer prepared from C and D,
- wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to all the acids;
- 10 E) from the reaction product of C and/or D with aliphatic and/or cycloaliphatic bifunctional and additionally optionally more highly functional isocyanates, preferably having 1 to 12 C atoms or 5 to 8 C atoms in the case of cycloaliphatic isocyanates, for example tetramethylene diisocyanate, hexamethylene diisocyanate, isophorone diisocyanate, optionally additionally with linear and/or branched and/or cycloaliphatic bifunctional and/or more highly functional alcohols, preferably  $C_3-C_{12}$  alkylidiols or alkylpolyols or 5 to 8 C atoms in the case of cycloaliphatic alcohols, for example ethanediol, hexanediol, butanediol, cyclohexanedimethanol, and/or optionally additionally with linear and/or branched and/or cycloaliphatic bifunctional and/or more highly functional amines and/or aminoalcohols preferably having 2 to 12 C atoms in the alkyl chain, for example ethylenediamine or amin ethanol, and/or optionally further modified amines or alcohols, such as for example ethylenediaminoethanesulphonic acid, as the free acid or as a salt,
- 15 20 25 wherein the ester fraction C) and/or D) amounts to at least 75 wt.%, relative to the sum of C), D) and E),
- 30 aliphatic or aliphatic-aromatic polyestercarbonates prepared from

- 5           F)     aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol or particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having 5 to 8 C atoms in the cycloaliphatic ring, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably with C<sub>2</sub>-C<sub>12</sub> alkyldicarboxylic acids, such as for example neopentyl glycol, and additionally optionally small quantities of more highly functional alcohols, such as for example 1,2,3-propanetriol or trimethylolpropane and from aliphatic bifunctional acids, such as for example and preferably, succinic acid, adipic acid, and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid, or
- 10           G)     from acid- and alcohol-functionalised units, for example having 2 to 12 C atoms in the alkyl chain, for example hydroxybutyric acid, hydroxovaleric acid, lactic acid or the derivatives thereof, for example ε-caprolactone or dilactide,
- 15           or a mixture and/or a copolymer prepared from F and G,  
20           wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to all the acids,
- 25           H)     a carbonate fraction which is produced from aromatic bifunctional phenols, preferably bisphenol A, and carbonate donors, for example phosgene,  
30           or

a carbonate fraction which is produced from aliphatic carbonic acid esters or the derivatives thereof, such as for example chlorocarbonic acid esters or aliphatic carboxylic acids or the derivatives thereof, such as for example salts and carbonate donors, for example phosgene, wherein

5

the ester fraction F) and/or G) amounts to at least 70 wt.%, relative to the sum of F), G) and H);

10 aliphatic or partially aromatic polyesteramides prepared from

- I) aliphatic bifunctional alcohols, preferably linear C<sub>2</sub> to C<sub>10</sub> dialcohols, such as for example ethanediol, butanediol, hexanediol, particularly preferably butanediol and/or optionally cycloaliphatic bifunctional alcohols, preferably having 5 to 8 C atoms, such as for example cyclohexanedimethanol, and/or, partially or entirely instead of the diols, monomeric or oligomeric polyols based on ethylene glycol, propylene glycol, tetrahydrofuran or copolymers thereof having molecular weights of up to 4000, preferably of up to 1000, and/or optionally small quantities of branched bifunctional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkyldiols, such as for example neopentyl glycol, and additionally optionally small quantities of more highly functional alcohols, preferably C<sub>3</sub>-C<sub>12</sub> alkylpolyols, such as for example 1,2,3-propanetriol, trimethylolpropane and from aliphatic bifunctional acids, preferably having 2 to 12 C atoms in the alkyl chain, such as for example and preferably succinic acid, adipic acid and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalene-dicarboxylic acid and additionally optionally small quantities of more highly functional acids, such as for example trimellitic acid or
- 15
- K) from acid- and alcohol-functionalised units, preferably having 2 to 12 C atoms in the carbon chain, for example hydroxybutyric acid, hy-
- 20
- 25
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droxyvaleric acid, lactic acid or the derivatives thereof, for example ε-caprolactone or dilactide,

or a mixture and/or a copolymer prepared from I) and K),

5

wherein the aromatic acids constitute a fraction of no more than 50 wt.%, relative to all the acids,

- 10 L) an amide fraction prepared from aliphatic and/or cycloaliphatic bifunctional and/or optionally small quantities of branched bifunctional amines, with linear aliphatic C<sub>2</sub> to C<sub>10</sub> diamines being preferred, and additionally optionally small quantities of more highly functional amines, the amines preferably being hexamethylenediamine, isophoronediamine and particularly preferably hexamethylenediamine, and from linear and/or cycloaliphatic bifunctional acids, preferably having 2 to 12 C atoms in the alkyl chain or a C<sub>5</sub> or C<sub>6</sub> ring in the case of cycloaliphatic acids, preferably adipic acid, and/or optionally small quantities of branched bifunctional and/or optionally aromatic bifunctional acids, such as for example terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid and additionally optionally small quantities of more highly functional acids, preferably having 2 to 10 C atoms,  
20 or  
15 M) from an amide fraction prepared from acid- and amine-functionalised units, preferably having 4 to 20 C atoms in the cycloaliphatic chain, preferably ω-laurolactam, ε-caprolactam, particularly preferably ε-caprolactam,

25 or a mixture prepared from L) and M) as the amide fraction, wherein

30

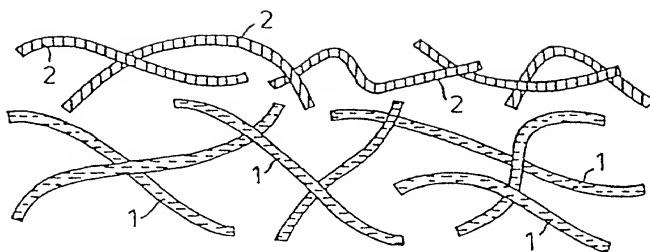
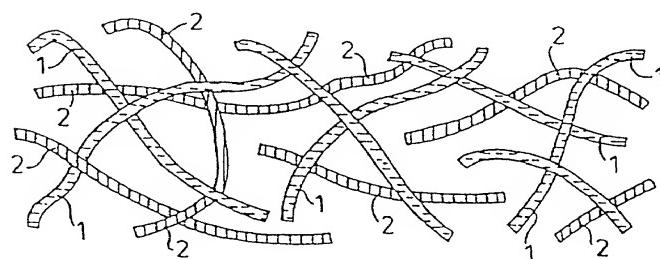
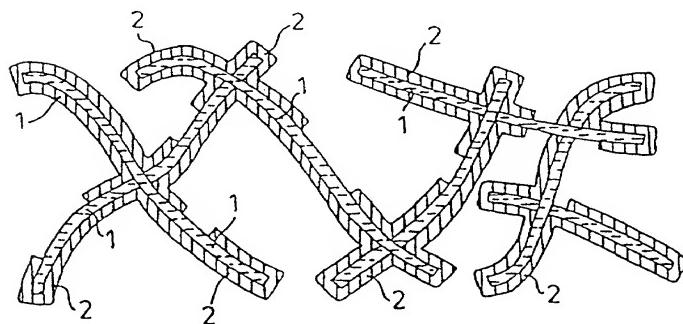
the ester fraction I) and/or K) amounts to at least 30 wt.%, relative to the sum of I), K), L) and M).

3. A filter material according to claims 1 and 2, wherein the first ply is a mixture of coniferous wood, deciduous wood, manilla, hemp, jute, sisal and similar natural fibres.
5. A filter material according to claims 1 to 3, wherein the first ply has a basis weight of between 8 and 40 g/m<sup>2</sup> and an air permeability of 300 to 4000 l/m<sup>2</sup>-sec (DIN 53 887).
10. 5. A filter material according to claims 1 to 4, wherein the second ply, consisting of the biodegradable thermoplastic fibres, has a basis weight of 1 to 15 g/m<sup>2</sup>.
6. A filter material according to the preceding claims, wherein the first ply of natural fibres is provided with wet strength.
15. 7. Use of the filter material according to the preceding claims for the production of tea bags, coffee bags or tea or coffee filters.

A b s t r a c t

**Heat-sealable filter material containing biodegradable polymers**

A filter material consisting of an at least two-ply structure, wherein at least one ply contains natural fibres and one ply biodegradable, thermoplastic fibres, wherein the thermoplastic fibres are selected from the group comprising aliphatic or partially aromatic polyesteramides, aliphatic or partially aromatic polyesters, aliphatic or partially aromatic polyesterurethanes, aliphatic or aliphatic-aromatic polyestercarbonates.

**Fig. 1****a)****b)****c)**

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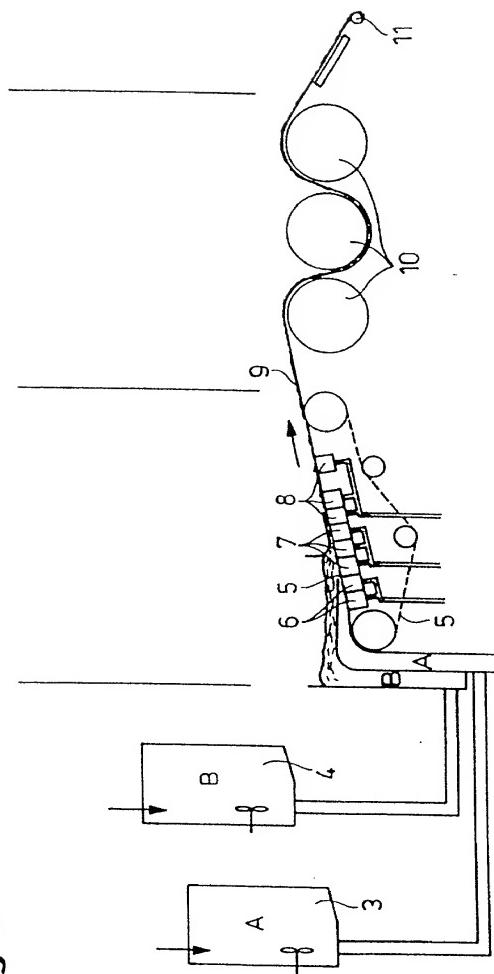
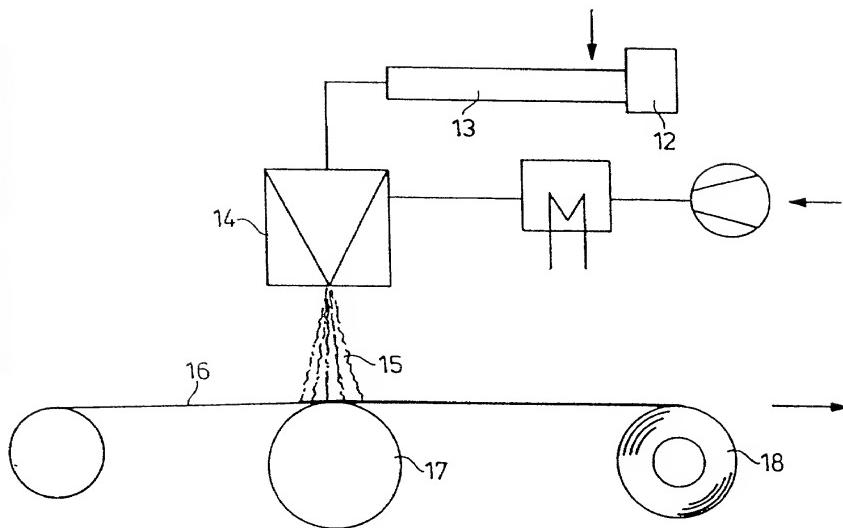


Fig. 2

**Fig. 3**

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COMBINED DECLARATION AND POWER OF ATTORNEY

ATTORNEY DOCKET NO

As a person named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"HEAT-SEALABLE FILTER MATERIAL WITH BIODEGRADABLE POLYMERS"

the specification of which is attached hereto,

or was filed on **April 30, 1998**

as a PCT Application Serial No. **PCT/EP98/02553**

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s), the priority(ies) of which is/are to be claimed:

**197 19 807.4**  
(Number)

**Germany**  
(Country)

**May 13, 1997**  
(Month/Day/Year Filed)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose the material information as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

(Application Serial No.)	(Filing Date)	(Status)
		(patented, pending, abandoned)

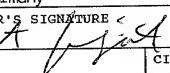
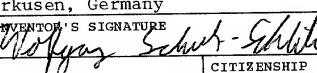
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Le A 32 344-US

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